

observations on the frequency of the recurrence of the process of fission, by the continual following of one segmental product of the act; and also from its beginning to its cessation, in a series of separate organisms, making manifest the periods of greatest fission intensity; and also showing the result following on the cessation of fission. In the majority of cases it was an exhaustion of vital action and death: but in a certain proportion, in which fission was not so long continued, it was a rapid change to an amoeboid condition, resulting in the absorption or fusing of the lateral flagella with the body, and a change of form; the organism becoming now quite oval and having only an anterior flagellum. It swims easily, but has lost all the power and freedom of motion possessed before, moving only in a straight line. But it soon comes into contact with a colony of the organism in the springing condition, attaches itself to one of them, which then soon unanchors and both swim away. In the course of time their movements become sluggish; the sarcodae of the bodies is palpably blending, they become quite still, except for amoeboid movements, and then become one mass, oval in form, which elongates into a spindle-shape, remaining motionless and still in all respects for three or four hours; when, as was ultimately, and by long continued effort made out, it pours out exquisitely minute, opaque, apparently round specks, which, when carefully and steadily followed with the best appliances, were seen to develop into the adult form and size.

The author then desired to discover the relative heat-resisting power of the perfect form, and the germ or spore. The adult forms were proved by a very direct method, which was fully detailed, to be wholly destroyed at a temperature of 142° F. Two methods of heating were employed to test the resistance of the spore. One was the "dry" method which had been employed in the former researches; but which was somewhat modified and used with special precautions; and the result of an elaborate series of experiments proved, that by this mode of heating, the spore could resist a temperature of 250° F.

It was next determined to test the heat resistance of the spore when they suffered the heat, diffused in a fluid. The difficulty of accomplishing this, so as to secure an unmistakable result was carefully pointed out and dwelt on; and the opinion recently expressed by Dr. Bastian that it was "perfectly easy" shown to be an error.

The apparatus employed for the purpose was specially delicate, but enabled the author to test directly the results of heat on the spores as well as on the adult organism, without exposure after the vessel was once sealed. The form used was specially devised for these observations. The temperatures up to the boiling point of water were got in melted paraffin, and higher temperatures in a digester. The result was that 220° F. was found to be the limit of temperature which the spore of this organism could endure without destruction of vitality. That is to say 30° F. lower than the same spores could bear in a "dry" heat. But it was pointed out, that to endure this temperature, implied protection of some kind: but that this in the *undeveloping* germ, was not only capable of being understood, but would doubtless prove of immense value to the organism.

#### OUR ASTRONOMICAL COLUMN

THE UNIVERSITY OBSERVATORY, OXFORD.—Prof. Pritchard has published No. 1 of *Astronomical Observations made at the University Observatory, Oxford*. It comprises observations made between the autumn of 1875, when the establishment was first organised, and the end of 1877. They relate to the satellites of Saturn, double stars, and the five comets discovered in 1877, by

Borrelly, Winnecke, Swift, Coggia, and Tempel, for which provisional elements and, in the case of Winnecke's comet, an extensive ephemeris are added; also elements of the orbits of  $\xi$  Ursæ Majoris, 70 Ophiuchi, and  $\mu^2$  Boötis, and comparison of the same with the interpolation curve drawn according to the method of Sir J. Herschel. The observations of the satellites of Saturn consist of differences of R.A. and N.P.D. from the centre of the primary, facilitated by the ephemerides which Mr. Marth has regularly supplied; together with the other observations now printed, they have been made with the refractor of 12½-inches aperture, constructed for the observatory by Mr. Howard Grubb, of Dublin, Mr. W. E. Plummer, the first assistant, being credited with the greater part of them. In addition to the above work, it is mentioned that nearly twelve hundred measurable photographs have been secured by means of Dr. De la Rue's reflector, which he presented to the Observatory, and which is mounted in the eastern dome, and a very beautiful instrument for completing the measurement of these photographs has been recently received through the liberality of the same gentleman. The institution is under the control of a Board of Visitors, as usual in so many of the more important astronomical establishments at the present day, the Board being composed of the Vice-Chancellor, the Proctors, the Astronomer-Royal, the Director of the Cambridge Observatory, the Radcliffe Observer, and four other members elected by the Convocation of the University; these members are at present, Dr. De la Rue, Prof. Bartholomew Price, J. A. Dale, M.A., and W. Esson, M.A.

The position of the University Observatory is in latitude 51° 45' 34" 15, and longitude 5m. 04os. west of Greenwich.

THE CINCINNATI OBSERVATORY.—No. 4 of the publications of this observatory, just issued, contains the results of measures of double stars made in the year 1877, with the 11-inch refractor, the object-glass of which was replaced early in the year after having been successfully refigured by Alvan Clark and Sons; in addition to this improvement a new driving clock was added. The stars measured are, with very few exceptions, situate between the equator and 40° of south declination, and this selection of objects gives a rather special value to the Cincinnati observations, though it has been notified from Melbourne that the remeasurement of Sir John Herschel's southern stars is in progress there. The methods of observing at Cincinnati, and the investigation of personal equation, are explained in the introduction, and the larger differences in the measured angles and distances, found on comparison with the catalogues of Struve, Sir John Herschel, Jacob (Poona), and Dembowski's measures of doubles discovered by Mr. Burnham, are indicated. Some of these larger differences occur in the case of well-known rapidly-moving binaries; but there are others which deserve further attention, to decide upon the cause of the observed changes. The following may be mentioned:—

Star.	SIR J. HERSCHEL'S MEASURES.			CINCINNATI MEASURES.		
	Pos.	Dist.		Pos.	Dist.	
$\lambda$ 2036	1836° 54...	40° 4	"	1877° 76...	25° 1	1° 40.
Lalande... 2416	36° 96...	—	1° 82			
$\lambda$ 3447	1837° 11...	75° 5	—	1877° 80...	90° 1	2° 20
Lacaille ... 462	37° 51...	—	3° 12			
$\lambda$ 3461	1836° 54...	69° 6	—	1877° 85...	59° 0	4° 84.
$\epsilon$ Sculptoris ...	36° 70...	—	5° 53			

Of stars observed by Sir J. Herschel with the 20-foot reflector, for Nos. 2,904, 3,494, and 5,113 (which are respectively Lacaille 8,262, 702, and 8,098), the Cincinnati measures show differences greater than 20". The positions of these stars for 1880 are:—

	Right Ascension.	S. Declination.
	h. m. s.	
$\lambda$ 2036 .....	1 14 4	16 26
„ 3447 .....	1 30 35	30 31
„ 3461 .....	1 40 1	25 39
„ 3494 .....	2 14 46	35 59
„ 5113 .....	19 17 30	29 32
„ 2904 .....	19 47 7	24 14

The "mean results" at the end of this publication apply to upwards of 500 objects.

THE REAPPEARANCE OF ENCKE'S COMET.—Dr. von Asten, in an extract from the *Bulletin* of the St. Petersburg Academy, has circulated an ephemeris of Encke's comet for the return in the present year, and it is also printed in No. 2,197 of the *Astronomische Nachrichten*. The elements have been perturbed to April 24, 1878, taking into account the attraction of the six old planets and the effect of a resisting medium. The perihelion passage takes place July 26<sup>h</sup> 11<sup>m</sup> 59<sup>s</sup>, G.M.T., and Dr. von Asten especially insists upon the importance of observations in the southern hemisphere after perihelion, for the improvement of the theory, and urges that at least two complete series of observations with moderately powerful instruments should be obtained, for reasons which he states are explained in a memoir now in the press. The following positions are interpolated from his ephemeris for Berlin noon, corresponding to 8h. 46m. mean time at Melbourne:—

	Right Ascension.	North Polar Distance.	Log. Distance from the earth.
	h. m. s.		
August 1 ...	9 46 0	79 19.8	0.0824
„ 5 ...	10 17 23	83 53.8	0.0597
„ 9 ...	10 47 39	88 28.0	0.0399
„ 13 ...	11 17 24	92 58.0	0.0248
„ 17 ...	11 47 0	97 18.8	0.0155
„ 21 ...	12 16 30	101 24.3	0.0123
„ 25 ...	12 45 47	105 8.7	0.0151
„ 29 ...	13 14 34	108 27.3	0.0233
Sept. 2 ...	13 42 30	111 17.4	0.0359

The elements of the orbit for April 24, 1878, are: longitude of perihelion,  $158^{\circ} 19' 41''$ , ascending-node,  $334^{\circ} 39' 10''$  (M. Eq. 1878.0), inclination,  $13^{\circ} 6' 40''$ , eccentricity, 0.8491669, semi-axis major, 2.210691. The perihelion distance is 0.33344, the aphelion distance, 4.08794, and the semi-minor-axis, 1.16752. The sidereal period at the above date is 1200.8 days.

### NOTES

THE funeral of the late Prof. Henry, at Washington, was an imposing pageant, being attended by the President and the members of the Cabinet and the Congress—the latter body adjourning from respect to his memory—with a large number of prominent men from all parts of the country. Prof. Spencer F. Baird succeeds Prof. Henry as secretary to the Smithsonian Institution.

A MONUMENT to the late eminent physicist, Dr. Robert von Mayer, will be erected at Heilbronn, in Würtemberg. Herr Gustav Rümelin, the Chancellor of Tübingen University and well-known critic of Shakespeare, will shortly publish a biography of Dr. von Mayer.

PROF. HELMHOLTZ has written to the Royal Institution to obtain a bust of Faraday, and to the French Academy of Sciences for busts of Ampère and Regnault. No bust of Regnault being in existence, one will be executed at the expense of the Government, by M. Noel, and placed in the Hall where the Academy meets. A cast will be sent to Berlin as requested.

THE honorary membership of the Geographical Society of Italy, at Rome, has recently been conferred on Dr. George Bennett, of Sydney, who is well known as a naturalist and traveller, and who it seems had been exceedingly active in

the furthering of Signor L. M. d'Albertis' late expedition to New Guinea.

PROF. ERNST HAECKEL has been nominated honorary member of the Geographical Society of Lisbon and of the Microscopical Society of San Francisco.

THE system of science and art education which centres at South Kensington and branches to the remotest parts of the kingdom, has years ago assumed the dimensions of a national organisation and done more, probably, than any other means, to foster a wide-spread artistic taste and a desire for scientific knowledge among the people. The well-trained teachers of the department are everywhere doing their humanising and elevating work. This immense organisation, every one now admits, is mainly due to the energy, intelligence, and foresight of one man, Sir Henry Cole, who has happily survived much that would have daunted a less enthusiastic and public-spirited man—survived to receive, as he did last Thursday, a well-earned and appropriate honour. On that day a large number of ladies and gentlemen assembled at Grosvenor House, by the permission of the Duke of Westminster, for the purpose of presenting to Sir Henry Cole a testimonial, the result of an effort originated some years ago. The memorial was in the form of a marble bust and memorial tablet in della robbia ware, containing a portrait of Sir Henry in mosaic. The total amount of subscriptions was 2,924*l.* 13*s.* 4*d.* After paying expenses for the monument, portrait, and bust, Sir H. Cole had already received 2,000*l.* The Duke of Westminster, in presenting the testimonial, bore testimony to the advantages which Sir Henry Cole had conferred upon the nation in his efforts to promote the development of science and art. Sir Henry Cole, in acknowledgment, said his words could but feebly express his hearty thanks to the princes, peers, commoners, men of science, art, and literature, industrial producers and handworkers, who had joined in this testimonial. After fifty years of public life, with his health declining from the constant strain of official work, he (Sir H. Cole) felt it right to resign his duties. He was not idle in his leisure. His health had improved, and he hoped still to do some useful public work. He was trying to obtain a national recognition for music, the first and most popular of all fine arts, to help elementary education to become the work of the people rather than of the State, and to promote improved health throughout the country. The portrait in mosaic of Sir Henry is to be offered to the South Kensington Museum. The marble bust will be presented to his Royal Highness the Prince of Wales, as president of the Albert Hall, with a request that it should have a suitable place in the Hall.

A STRANGE jubilee is proposed to be celebrated in Italy during 1879. Our readers know that next year 1,800 years will have elapsed since the two cities of Pompeii and Herculaneum were destroyed by earthquakes and eruptions from Mount Vesuvius. It is now intended to celebrate the anniversary of that year of destruction, and the site of the celebration is to be at Pompeii itself, as being the better known of the two buried cities.

In the April number of the *Bulletin* of the Imperial Academy of St. Petersburg it is stated that a clergyman named Pervouchine has proved that the number  $2^{2^{12}} + 1$  is divisible by  $7 \cdot 2^{14} + 1$ . Bouniakowsky has verified the result at the request of the Academy. Hitherto the only exception known to Fermat's statement, that all numbers of the form  $2^{2^m} + 1$  are primes, is that of  $m = 5$  where Euler showed that  $641$  is a divisor.

M. C. TH. LIEBE (*Proc. Imper. Geol. Instit.*, Vienna, March 5, 1878) has found a considerable quantity of remains of the Marmot in the Diluvium near Gera (Thuringia), indicating